MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE. Assistant Editor: CLEVELAND ABBE, jr.

VOL. XXXVII. MAY, 1909. No. 5

The MONTHLY WEATHER REVIEW summarizes the current manuscript data received from about 3,500 land stations in the United States and about 1,250 ocean vessels; it also gives the general results of the study of daily weather maps based on telegrams or cablegrams from about 200 North American and 40 European, Asiatic, and oceanic stations.

The hearty interest shown by all observers and correspondents is gratefully recognized.

Acknowledgment is also made of the specific cooperation of the following chiefs of independent, local, or governmental services: R. F. Stupart, Esq., Director of the Meteorological Service of the Dominion of Canada; Señor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Señor Camilo A. Gonzales, Director-General of Mexican Telegraphs; Capt. S. I. Kimball, General Superintendent of the United States Life-Saving Service; Commandant Francisco S. Chaves, Director of the Meteorological Service of the Azores, Ponta Delgada, St. Michaels, Azores; Dr. W. N. Shaw, Director of the Meteorological Office, London; Maxwell Hall, Esq., Government Meteorologist, Kingston, Jamaica; Rev. L. Gangoiti, Director of the Meteorological Observatory of Belen College, Habana, Cuba; Señor Luis G. y Carbonell, Director, Meteorological Service of Cuba, Habana, Cuba; Rev. José Algué, S. J., Director of the Phillipine Weather Bureau, Manila; Maj. Gen. M. A. Rykachef, Director of the Physical Central Observatory, St. Petersburg, Russia; Carl Ryder, Director, Danish Meteorological Institute, Copenhagen, Denmark.

As far as practicable the time of the seventy-fifth meridian is used in the text of the MONTHLY WEATHER REVIEW.

Barometric pressures, both at land stations and on ocean vessels, whether station pressures or sea-level pressures, are reduced, or assumed to be reduced, to standard gravity, as well as corrected for all instrumental peculiarities, so that they express pressure in the standard international system of measures, namely, by the height of an equivalent column of mercury at 32° Fahrenheit, under the standard force, i. e., apparent gravity at sea-level and latitude 45°.

FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

The movements of barometric areas over the continents of the Northern Hemisphere were more irregular than during the preceding month. Over the Pacific Ocean pressure fluctuations were frequent in the Bering Sea region and the barometer continued comparatively high over the Hawaiian Islands until the close of the month, when readings were slightly below 30.00 inches. Over the Atlantic Ocean pressure was high in northern and low in southern latitudes during the first two decades of the month. This distribution of pressure over the Atlantic gave during the period named prevailing northerly winds over the continental areas that bordered on the middle latitudes of the ocean. On the middle and northern Atlantic coasts of the United States the winds were northeasterly and on the western European coasts they were mostly northwesterly. From the 21st until the close of the month lower pressure in northern and higher pressure over southern latitudes of the Atlantic caused a shift of winds to warmer southerly and westerly over the eastern American and western European coastal regions.

In the United States the month opened with rain in the middle Atlantic and New England States, snow in the upper Lake region and upper Mississippi and Ohio valleys, freezing temperature north of a line traced from the upper Lake region to southeastern New Mexico and killing frosts in the States of the Ohio, upper Mississippi and lower Missouri valleys and the middle and southern Rocky Mountain districts. The morning of the second light to heavy frost was reported in northern portions of the middle and east Gulf States and western portions of the south Atlantic States,and a minimum of 37° was noted at Washington, D. C., the lowest recorded temperature for May at that station being 33° on May 11, 1906. During this cool period in central and eastern districts summer temperature prevailed in the extreme Southwest, with maximum readings 96° at Yuma, Ariz.

The Fort Worth, Tex., Record, of May 5, refers editorially as follows to action taken by Colorado fruit growers to protect their crops from the cold wave of April 30–May 1:

There was an illustration in Colorado last week of how man's ingenuity combats the elements and sometimes thwarts the full workings of nature. Colorado fruit growers had been warned of the coming of the cold wave which, there was every evidence to believe, would blast the fruit crop. The fruit crop in the threatened Grand Valley is estimated to be worth $3,000,000. Fruit growers immediately got busy with the smudge pot. These oil heaters performed the miracle of heating the whole out of doors. The danger-point to the fruit crop is 28° and the smudge pots pushed the thermometer register up to 32°. The orchards were saved. The cost of equipment was an average of $25 an acre, the cost of running $5 a night, and the estimate is that not more than three nights a year would such precautions be necessary; hence at a cost of $40 there was saved each acre's crop, the value of which runs from $300 to $2,000.

From the 2d to 7th a depression of slight intensity advanced from the north Pacific coast to the Canadian Maritime Provinces, preceded by rapidly rising temperature, attended by showers in middle and northern districts east of the Rocky Mountains and followed by a decided fall in temperature that carried the frost line over the upper Mississippi Valley.

An important disturbance advanced from the middle Plateau to New England from the 7th to 11th, attended by severe local storms in Oklahoma and Missouri on the 8th and in the Ohio Valley and Tennessee on the 9th. The rains attending this disturbance were moderate to heavy in practically all sections from the Mississippi Valley to the Atlantic coast, and a cool wave that followed its passage was attended by freezing temperature in the upper Lake region and northern New England and carried the frost line over the lower Missouri, upper Mississippi and Ohio valleys, Kentucky, and the mountain districts of the south Atlantic States.

From the 10th to 15th, and 14th to 17th, respectively, disturbances advanced from the plateau over the central valleys, and from the southern Rockies to the St. Lawrence Valley. Preceding these disturbances temperature rose rapidly and the highest readings of the present year, 90°, were noted on the 15th in the middle Atlantic States. From the 13th to 15th heavy local rains occurred from the northern Rocky Mountains and middle Plains States over the upper Mississippi and Ohio val-

leys and the southern Lake region and in parts of central and eastern Texas and the middle and west Gulf States. From the 12th to 15th a cool wave advanced from the Plateau over the Rockies, with minimum temperature 23° at Cheyenne, Wyo., the morning of the 14th. This is the lowest temperature on record for Cheyenne for so late a date in May. From the 15th to 17th heavy snow fell at points in the northern Rocky Mountain districts.

From the 18th to the 21st an area of low pressure that moved slowly eastward over the Gulf States and high pressure from the Lake region over the Canadian Maritime Provinces caused cool and unsettled weather generally over the eastern portion of the country, with heavy rains from Texas over the middle and east Gulf States that gradually extended over the south and middle Atlantic States and southern New England. During the 22d and 23d the center of the southern depression moved northeastward near the Atlantic coast attended by northeast gales from North Carolina to Maine.

A disturbance that moved from the middle plateau to the north Atlantic coast from the 22d to 28th was attended by heavy rains east of the Rockies. A severe and widespread barometric disturbance developed over the plateau region on the 27th and advanced over the Plains States and Mississippi Valley during the 28th and 29th, where it remained nearly stationary with a gradual loss of strength until the close of the month. The rain area that attended this storm extended from the middle and north Pacific coast over the middle and northern plateau and Rocky Mountain districts and covered the Plains and Gulf States and central valleys. During the 29–30th severe local storms occurred in the middle and west Gulf States, Oklahoma, and the Missouri Valley and well-defined tornados were reported the night of the 29th in North Dakota and in Brown County, Texas.

BOSTON FORECAST DISTRICT.

[New England.]

Temperature was generally below the seasonal average with much cloudy and unsettled weather and frequent showers. Snow flurries occurred in parts of the three northern States, but the only measurable amount was 5 inches at Jacksonville, Vt. No heavy wind storms occurred. Storm warnings were ordered on the 9th, 21st and 22d. Frost warnings were sent to cranberry growers on the 11th, and temperatures of freezing or below occurred in the cranberry growing sections on the morning of the 12th. There were no storms without warnings, and no frosts in the cranberry regions without warnings.—*J. W. Smith, District Forecaster.*

NEW ORLEANS FORECAST DISTRICT.*

[Louisiana, Texas, Oklahoma, and Arkansas.]

The month opened moderately cool and frosts occurred over the northern portion of the district on a few dates during the first decade, for all of which warnings had been issued. Precipitation was below normal during the first half and above normal during the latter half of the month. Storm warnings were issued for the west Gulf coast on the 5th and 8th. No general storms occurred without warnings.—*I. M. Cline, District Forecaster.*

LOUISVILLE FORECAST DISTRICT.*

[Kentucky and Tennessee.]

Temperature averaged below normal and the first three or four days were decidedly cold. Snow flurries occurred in northern Kentucky on the 1st and 2d. Frost was general over both States on those dates and considerable frost was reported on the morning of the 11th. After the 4th temperature was more seasonable, although there were several cool periods. Rains were frequent and thunderstorms numerous. Precipitation was considerably above normal in western Tennessee and averaged about normal over the rest of the district. Frost warnings were issued for the entire district on the mornings of the 1st and 10th.—*F. J. Walz, District Forecaster.*

CHICAGO FORECAST DISTRICT.*

[Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas, and Montana.]

The month opened with strong westerly winds and snow flurries on the upper lakes for which warnings were issued on the last of April. Warnings were again displayed on the 5th in anticipation of a storm that moved from the Rockies directly eastward. Warnings were hoisted on the 15th, 25th, and 30th as storms of considerable intensity approached the Lake region. No casualties of any kind during the month on the upper lakes have been reported, and it is probable that vessel men generally took advantage of the ample warnings given them. A few frost warnings were issued, but as the season was later than usual they were not of much importance.—*H. J. Cox, Prof. and District Forecaster.*

DENVER FORECAST DISTRICT.*

[Wyoming, Colorado, Utah, New Mexico, and Arizona.]

The month was colder than the average throughout the district, and freezing temperatures, for which timely and accurate warnings were issued, visited the agricultural districts. Precipitation was below normal except in northern Utah. The prevailing low temperatures prevented in a marked degree the melting of snow at high altitudes, and the streams rising near the Continental Divide discharged no unusual amounts. The Rio Grande, it is true, was at a high stage, beginning the 10th, as a result of the melting of snow in northwestern New Mexico, but temperatures were too low for the usual flow from the high mountains of southwestern Colorado. Timely warnings were issued for the high stage in the lower Rio Grande.—*F. H. Brandenburg, District Forecaster.*

SAN FRANCISCO FORECAST DISTRICT.†

[California and Nevada.]

The month was abnormally dry, and following an April almost without rain the season has been a remarkably dry one. Unusually heavy and continued rains in January, February, and March indicated a wet season. The snow covering in the mountains at the end of March was one of the deepest ever known; yet notwithstanding moist ground, full streams and deep snow cover there has practically been a cessation of precipitation throughout California since the end of March. There were no warm spells until the close of the month when temperatures exceeded 100° at Redlands, Riverside, Pasadena, San Bernardino, and other points in the San Gabriel valley. In the Sacramento and San Joaquin valleys afternoon temperatures reached 96°. No storm and no frost warnings were issued during the month.—*A. G. McAdie, Prof. and District Forecaster.*

PORTLAND, OREGON, FORECAST DISTRICT.†

[Oregon, Washington, and Idaho.]

The month was cooler than usual and the rainfall though deficient was well distributed. Warnings were issued in time to be of benefit for the only storm of sufficient strength to justify them. Warnings were issued a day ahead for all damaging and widespread frosts. Notwithstanding there was more snow in the mountains at the end of the month than usual the Columbia River did not begin to rise materially until the last two days. Prior to this time the stages in the lower Columbia were the lowest on record for the month of May.—*E. A. Beals, District Forecaster.*

RIVERS AND FLOODS.

Floods occurred during the month in the Allegheny River, the Grand River of Michigan, the Mississippi River between the mouth of the Des Moines River and Hannibal, Mo., the lower Arkansas watershed, central and southeastern Mississippi, western Alabama, the rivers of South Carolina and in the lower Roanoke River. The majority were unimportant,

* Morning forecasts made at district center; night forecasts made at Washington, D. C.

† Morning and night forecasts made at district center.